DOCUMENT RESUME

ED 481 361 CE 085 576

TITLE	Outdoor Power Equipment Technician Program. Apprenticeship Training.
INSTITUTION	Alberta Learning, Edmonton. Apprenticeship and Industry Training.
ISBN	ISBN-0-7785-2569-4
PUB DATE	2003-00-00
NOTE	62p.
AVAILABLE FROM	For full text: http://www.tradesecrets.org/trades/051/pdf/051_outline.pdf.
PUB TYPE	Guides - Non-Classroom (055)
EDRS PRICE	EDRS Price MF01/PC03 Plus Postage.
DESCRIPTORS	*Apprenticeships; *Auto Mechanics; Competency Based Education; *Course Content; Course Descriptions; Curriculum; Curriculum Development; Electronic Equipment; Employment Qualifications; Equipment Maintenance; Foreign Countries; Job Skills; Motor Vehicles; Occupational Safety and Health; Postsecondary Education; Skilled Occupations; *Small Engine Mechanics; State Regulation; Student Certification; *Trade and Industrial Education
IDENTIFIERS	*Alberta; Marine Equipment; Snowmobiles

ABSTRACT

This document presents information about the apprenticeship training program of Alberta, Canada, in general and the outdoor power equipment technician program in particular. The first part of the document discusses the following items: Alberta's apprenticeship and industry training system; the apprenticeship and industry training committee structure; local apprenticeship committees; provincial apprenticeship committees; the Alberta Apprenticeship and Industry Training Board; safety education; legal and administrative aspects of safety; technical training establishment; procedures for recommending revisions to the course outline; the apprenticeship route toward certification as a outdoor power equipment technician; and a outdoor power equipment technician training profile. The second part of the document presents course outlines for the first, second, third, and fourth periods of technical training. Selected topics covered in the four periods are as follows: safety and regulations; machine shop practices and welding; electrical theory and electrical circuits; bearings and seals; communication and manuals; assembly and pre-delivery; wheel hubs and tire maintenance; brakes; the theory of two- and four-stroke engines; frames and suspensions; fuel, ignition, charging, starting, and lubrication systems; exhaust and governors; tune-up and troubleshooting; hydraulics; engine overhauls; marine gear housings; and jet drives. The course outlines detail course topics, intended outcomes, specific behavioral objectives, and times allotted for each topic covered. (MN)

Reproductions supplied by EDRS are the best that can be made
from the original document.

CE CETR 0302

ED 481 361

APPRENTICESHIP TRAINING

Outdoor Power Equipment Technician Program

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

C. Andrew

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

Alberta
LEARNING
Apprenticeship and Industry Training

ALBERTA LEARNING CATALOGUING IN PUBLICATION DATA

Alberta. Alberta Learning. Apprenticeship and Industry Training.
Outdoor power equipment technician program.

ISBN 0-7785-2569-4

1. Power (Mechanics) - Study and teaching - Alberta. 2. Apprentices - Alberta.
3. Occupational training - Alberta. I. Title. II. Series: Apprenticeship Training.

HD4885.C2.P68.A333 2003 373.27

2003, Her Majesty the Queen in right of the Province of Alberta, as represented by the Minister of Learning, 10th floor, Commerce Place, Edmonton, Alberta, Canada, T5J 4L5. All rights reserved. No part of this material may be reproduced in any form or by any means, without the prior written consent of the Minister of Learning.

Care has been taken to acknowledge all sources and references in these materials. If there are any inadvertent omissions, please contact Alberta Learning, 10th floor, Commerce Place, Edmonton, Alberta, Canada, T5J 4L5.

Outdoor Power Equipment Technician

Table Of Contents

Apprenticeship and Industry Training System 4
Apprenticeship and Industry Training Committee Structure 4
Local Apprenticeship Committees (LAC) 4
Provincial Apprenticeship Committees (PAC) 5
The Alberta Apprenticeship and Industry Training Board (Board) 5
Safety Education 5
Legal and Administrative Aspects of Safety 6
Technical Training Establishment 6
Procedures For Recommending Revisions To The Course Outline 7
Apprenticeship Route Toward Certification 8
Outdoor Power Equipment Technician Training Profile 9

Course Outline

First Period Technical Training 15
Second Period Technical Training 29
Third Period Technical Training 39
Fourth Period Technical Training (Marine and Recreation) 46
Fourth Period Technical Training (Turf and Power) 54

Apprenticeship and Industry Training System

Apprenticeship is post-secondary education with a difference. It helps ensure Alberta has a steady supply of highly-skilled employees, the foundation of our economy's future health and competitiveness.

Apprentices in more than 50 trades and crafts spend between one and four years learning their trade - 80% of the time on the job under the supervision of a certified journeyman or qualified tradesperson. The balance of the program is technical training in the theory, skills and technologies of their trade.

To become certified journeymen apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board (the Board) and a network of local and provincial industry committees.

The graduate of the Outdoor Power Equipment Technician apprenticeship training is a journeyman who will be able to:

- repair, service, and maintain air and liquid cooled engines and related equipment including gasoline, diesel, propane and natural gas powered engines. (There are four branches of equipment).
- **Marine Equipment:** Outboard motors, stern, drives, jet drives in boats, hulls, boat trailers and accessories and personal water craft.
- **Power Equipment:** Mowers, saws, trimmers, pumps, generators, tillers, lawn and garden tractors, aerators, power rakers, seeders, sprayers, chippers/shredders, compaction equipment, air compressors, lift equipment and snow removal equipment.
- **Recreational Equipment:** Snowmobiles and multi-wheeled utility vehicles.
- **Turf Equipment:** Golf/turf specific power equipment including: greens movers, fairway mowers, aerators, sprayers, weeders, golf course irrigation systems, golf carts, and utility vehicles.

Apprenticeship and Industry Training Committee Structure

While government supports Alberta's apprenticeship and industry training system, it is driven by industry, a term which includes both employers and employees. The Alberta Apprenticeship and Industry Training Board, with the support of Alberta Learning, oversees the system. But the system relies on a network of industry committees. These committees include local and provincial apprenticeship committees (LACs and PACs) in the designated trades and occupational committees in the designated occupations, as well as other committees such as provisional committees established before the designation of a new trade or occupation comes into effect. All these committees are composed of equal numbers of employers and employees. The network of industry committees is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the Board can set up a LAC. The Board appoints equal numbers of employees and employers for terms of up to three years. The committee appoints a member as presiding officer. Local Apprenticeship Committees:

- monitor the apprenticeship system, and the progress of apprentices in their trade, at the local level.
- help settle certain kinds of issues between apprentices and their employers.
- recommend improvements in apprenticeship training and certification to their trade's provincial apprenticeship committee.
- make recommendations to the Board regarding the appointment of members to their trade's PAC.

Provincial Apprenticeship Committees (PAC)

The Board establishes a PAC for each trade and, based on PAC recommendations, appoints a presiding officer and equal numbers of employees and employers for terms of up to three years. Most PACs have nine members. Provincial Apprenticeship Committees:

- identify the training needs and content for their trade.
- recommend to the Board the standards for training and certification for their trade.
- monitor the activities of local apprenticeship committees in their trade.
- make recommendations to the Board about the designation of trades and occupations.
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in the trade.
- may participate in resolving any apprenticeship-related disputes between employers and employees.

Outdoor Power Equipment Technician PAC Members

Mr. C. Flathers	Calgary	Presiding Officer
Mr. W. Bernard	Edmonton	Employer
Mr. J. Bidulock	Edmonton	Employer
Mr. R. Macmillan	Calgary	Employer
Mr. T. Tupper	Edmonton	Employer
Mr. E. Williamson	Lethbridge	Employer
MR. S. Yee	Edmonton	Employer
MR. C. Cloutier	Calgary	Employee
Mr. N. Jacobs	Edmonton	Employee
Mr.T. Sedgwick	Edmonton	Employee
Mr. T. Smith	Grande Prairie	Employee
Mr. D. Swainson	Calgary	Employee
Mr. M. Van Hecke	Edmonton	Employee

The Alberta Apprenticeship and Industry Training Board (Board)

The mandate of the Alberta Apprenticeship and Industry Training Board relates to the standards and requirements for training and certification in programs under the *Apprenticeship and Industry Training Act.* The Board provides advice to the Minister of Learning on the training and certification of people in designated trades and occupations and on the needs of the Alberta labour market for skilled and trained persons. The Board also makes orders and regulations respecting standards and requirements for apprenticeship programs and the training of apprentices and for training and certification in designated trades and occupations, and the criteria or requirements for granting and recognizing trade and other certificates.

The 13-member Board consists of a chairman, eight members representing trades and four members representing other industries. The trades and other industry members are equally represented by employer and employee representatives.

Safety Education

Safe working procedures and conditions, accident prevention and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees and the public. Therefore, it is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to or cause an accident or injury.

It is generally recognized that a safe attitude contributes to an accident free environment. Everyone will benefit as a result of a healthy, safe attitude towards prevention of accidents. A tradesperson is possibly exposed to more hazards than any other person in the work force and, therefore, should be familiar with and apply the Occupational Health and Safety Act and Regulations dealing with personal safety and the special safety rules applying to each task.

Legal and Administrative Aspects of Safety

Accident prevention and the provisions of safe working conditions are the responsibilities of an employer and employee.

Employer's Responsibilities

The employer is responsible for:

- providing and maintaining safety equipment, and protective devices and clothing.
- enforcing safe working procedures.
- providing safeguards for machinery, equipment and tools.
- observing all accident prevention regulations.
- training employees in the safe use and operation of equipment.

Employee's Responsibilities

The employee is responsible for:

- working in accordance with the safety regulations pertaining to the job environment.
- working in such a way as not to endanger themselves or fellow employees.

Workplace Health and Safety's Responsibilities:

Workplace Health and Safety (Alberta Human Resources and Employment) will conduct periodic inspections of the workplace to ensure that safety regulations for industry are being observed.

Technical Training Establishment

Alberta Learning, Apprenticeship and Industry Training offer your apprenticeship training program. Staff and facilities for delivering the program are supplied by Fairview College St. Albert campus

Procedures For Recommending Revisions To The Course Outline

Apprenticeship and Industry Training, Industry Programs and Standards has prepared this course outline in partnership with the Outdoor Power Equipment Technician Provincial Apprenticeship Committee.

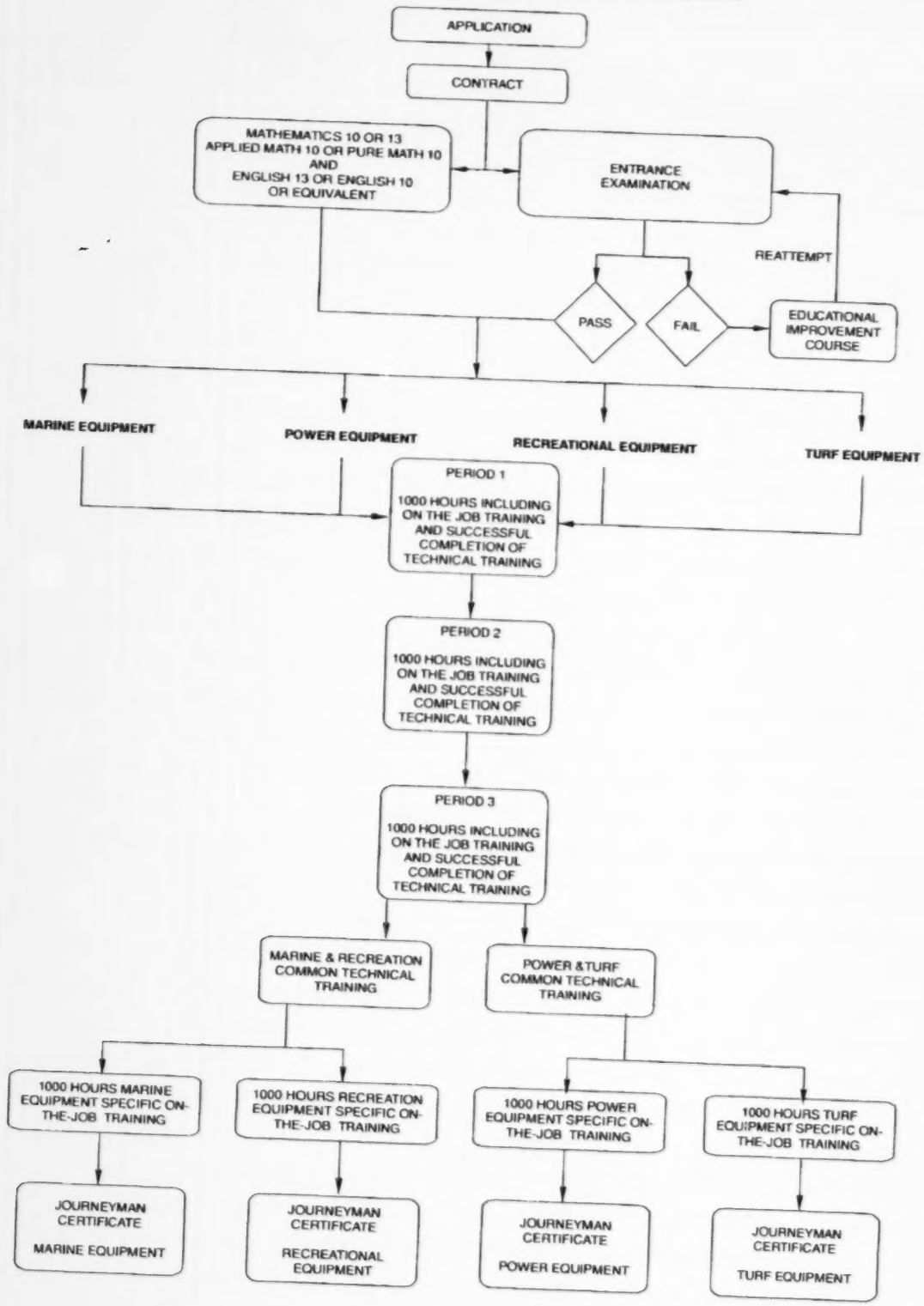
This course outline was approved on June 27, 2003 under the authority of the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. Valuable input is acknowledged from industry and the institutions.

Any concerned citizen or group in the Province of Alberta may make recommendations for change by writing to:

Outdoor Power Equipment Technician Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
10th floor, Commerce Place
10155 - 102 Street
Edmonton, AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations received will be placed before regular meetings of the Provincial Apprenticeship Committee.

Apprenticeship Route Toward Certification



BEST COPY AVAILABLE

Outdoor Power Equipment Technician Training Profile

First Period

(8 WEEKS 30 HOURS PER WEEK – TOTAL OF 240 HOURS)

SECTION ONE	**A**	**B**	**C**	
SAFETY 15 Hours ⇨	Safety and Regulations 4 Hours	Laws, Liabilities and Legalities 1 Hour	Fire Prevention and Control 3 Hours	
	D	**E**	**F.**	
	Storage of Fuels and Solvents 3 Hours	Battery Storage and Servicing 3 Hours	Use of Compressed Air 1 Hour	
SECTION TWO	**A**	**B**	**C**	
MACHINE SHOP PRACTICES AND OXYACETYLENE WELDING 45 Hours ⇨	Tools 20 Hours	Welding 22 Hours	Fasteners 3 Hours	
SECTION THREE	**A**	**B**	**C**	
BASIC ELECTRICAL 30 Hours ⇨	Introduction to Electrical Theory 10 Hours	Battery 3 Hours	Electrical Circuits 14 Hours	
	D			
	Electrical Wiring 3 Hours			
SECTION FOUR	**A**	**B**		
BEARINGS AND SEALS 10 Hours ⇨	Bearings 5 Hours	Seals 5 Hours		
SECTION FIVE	**A**	**B**	**C**	
COMMUNICATION AND MANUALS 20 Hours ⇨	Service Manuals 5 Hours	Basic Parts 5 Hours	Customer Service 5 Hours	
	D			
	Work Orders 5 Hours			
SECTION SIX	**A**	**B**	**C**	
ASSEMBLY AND PREDELIVERY 30 Hours ⇨	Unloading and Uncrating 5 Hours	Forklift Trucks 5 Hours	Parts Component List 5 Hours	
	D	**E**		
	Assembly 10 Hours	Manufacturer's P.D. I. Checklist 5 Hours		
SECTION SEVEN	**A**	**B**	**C**	
WHEELS, HUBS, AND TIRE MAINTENANCE 30 Hours ⇨	Types of Wheels 1 Hour	Wheel Inspection 2 Hours	Wheel Servicing 10 Hours	

	D Tires 1 Hour	E Tire Changing 16 Hours	
SECTION EIGHT **BRAKES** 30 Hours ⇨	A Nomenclature 1 Hour	B Hydraulic Theory 2 Hours	C Brake Design 1 Hour
	D Brake Inspection, Maintenance and Repair 12 Hours	E Changing and Bleeding Brake Fluid 1 Hour	F Master Cylinder, Calliper and Wheel Cylinder Rebuilding 11 Hours
	G Construction, Operation and Design Features of Electric Brake Systems. 2 Hours		
SECTION NINE **ENGINE THEORY OF 2 AND 4 STROKE ENGINES** 30 Hours ⇨	A Two Stroke 15 Hours	B Four Stroke 15 Hours	

SECOND PERIOD
(8 WEEKS 30 HOURS PER WEEK – TOTAL OF 240 HOURS)

SECTION ONE **FRAME AND SUSPENSIONS** 6 Hours ⇨	A Frame Types and Materials 1 Hour	B Suspension Types 5 Hours	
SECTION TWO **FUEL SYSTEMS** 45 Hours ⇨	A Induction System 5 Hours	B Fuel 2 Hours	C Pumps and Supply 3 Hours
	D Carburetor 15 Hours	E Electronic Fuel Injection 10 Hours	F Diesel 10 Hours
SECTION THREE **IGNITION SYSTEMS** 40 Hours ⇨	A Flywheel Magneto Ignition System 10 Hours	B Mechanical and Electronic Ignition Systems 15 Hours	C Ignition, Kill and Interlock Switch Systems. 10 Hours
	D Spark Plugs, Wires and Caps 3 Hours	E Testing and Troubleshooting 2 Hours	
SECTION FOUR **CHARGING SYSTEMS** 20 Hours ⇨	A Alternators 20 Hours		

SECTION FIVE

STARING SYSTEMS 30 Hours

- A: Starters — 30 Hours

SECTION SIX

EXHAUST AND GOVERNORS 10 Hours

- A: Exhaust — 4 Hours
- B: Governors — 6 Hours

SECTION SEVEN

COOLING SYSTEMS 18 Hours

- A: Air Cooling — 2 Hours
- B: Liquid Cooling — 10 Hours
- C: Oil Cooling — 6 Hours

SECTION EIGHT

LUBRICATION SYSTEMS 12 Hours

- A: Oils — 1 Hour
- B: Oil Pumps — 2 Hours
- C: Filtration Systems — 3 Hours
- D: Lubrication Circuits — 3 Hours
- E: Two Stroke Lubrication — 3 Hours

SECTION NINE

TUNE UP AND TROUBLESHOOTING 59 Hours

- A: Air Filters — 1 Hour
- B: Engine Compression — 3 Hours
- C: Tune up and Troubleshooting — 55 Hours

THIRD PERIOD

(8 Weeks 30 Hours Per Week – Total of 240 Hours)

SECTION ONE

HYDRAULICS 80 Hours

- A: Hydraulic Basics — 6 Hours
- B: Pumps and Motors — 12 Hours
- C: Cylinders — 12 Hours
- D: Lines — 1 Hour
- E: Hydraulic Fluids — 1 Hour
- F: Control Valves — 3 Hours
- G: Pressure Valves — 3 Hours
- H: Testing — 42 Hours

SECTION TWO

BASIC DRIVES 60 Hours

- A: Gear and Drive Ratios — 3 Hours
- B: Belt Drives — 3 Hours
- C: Chain Drives — 3 Hours
- D: Clutches — 20 Hours
- E: Transmission — 20 Hours
- F: Fluid Drives — 3 Hours
- G: Differentials — 6 Hours
- H: Drive Shafts and Universal Joints — 2 Hours

SECTION THREE	**A**	**B**	**C**
ENGINE OVERHAULS 95 Hours ⇨	Engine Failures 2 Hours	Measurement and Inspection 30 Hours	Recondition Parts 20 Hours
	D	**E**	
	Reassembly of Engines 40 Hours	Testing of Rebuilt engine and Final Adjustments 3 Hours	
SECTION FOUR	**A**		
ADVISORY NETWORK AND COACHING SKILLS 5 Hours ⇨	Advisory Network and Coaching Skills 5 Hours		

FOURTH PERIOD
MARINE AND RECREATION
(6 Weeks 30 Hours Per Week – Total of 180 Hours)

SECTION ONE	**A**	**B**	**C**
FUEL SYSTEMS 30 Hours ⇨	Marine Fuel Systems 1 Hour	Advanced Carburetion 2 Hours	Carburetor Troubleshooting 10 Hours
	D	**E**	**F**
	Jetting Principles 2 Hours	Oil Injection 3 Hours	Advanced Fuel Injection 12 Hours
SECTION TWO	**A**		
IGNITION SYSTEMS 25 Hours ⇨	Marine and Recreation Ignition Systems 25 Hours		
SECTION THREE	**A**	**B**	**C**
MARINE GEAR HOUSINGS 25 Hours ⇨	Shifting 2 Hours	Shimming 20 Hours	Transom Plates 3 Hours
SECTION FOUR	**A**	**B**	
JET DRIVES 10 Hours ⇨	Pumps 2 Hours	Jet Drive Maintenance 8 Hours	
SECTION FIVE	**A**		
POWER TRIM 20 Hours ⇨	Power Trim 20 Hours		
SECTION SIX	**A**	**B**	
PROPS AND HULLS 10 Hours ⇨	Props 6 Hour	Hulls 4 Hours	
SECTION SEVEN	**A**	**B**	**C**
RECREATION DRIVE TRAINS 30 Hours	Recreational Vehicle Clutches 20 Hours	Tracks 2 Hours	Driveline 8 Hours
SECTION EIGHT	**A**	**B**	**C**
STEERING AND SUSPENSION 20 Hours ⇨	Steering 5 Hours	Shocks 5 Hours	Front Suspension 5 Hours

D

Rear Suspension
1 Hour

SECTION NINE

ACCESSORIES AND PERFORMANCE MODIFICATION
10 Hours

A

Electrical Accessories
1 Hour

B

Engine Accessories
5 Hours

Hull Accessories
3 Hours

D

Trailer Accessories
1 Hour

FOURTH PERIOD
TURF AND POWER
(6 Weeks 30 Hours Per Week – Total of 180 Hours)

SECTION ONE

ADVANCED FUEL SYSTEMS
25 Hours

A

Power and Turf Equipment EFI and Sensor Servicing
10 Hours

B

Liquid Petroleum Gas
3 Hours

C

Kerosene
1 Hour

D

Diesel
11 Hours

SECTION TWO

ADVANCED TRANSMISSIONS
25 Hours

A

Tranaxles
6 Hours

B

Shift Mechanisms
1 Hour

C

PTO Drives
2 Hours

D

Final Drives
6 Hours

E

Hydrostatic Drives
10 Hours

SECTION THREE

ELECTRICAL/ELECTRONIC CONTROL SYSTEMS
25 Hours

A

Safety Interlocks and Rela;ys
15 Hours

B

Computer and Automated Control Systems
10 Hours

SECTION FOUR

CUTTING UNITS
30 Hours

A

Mowing Equipment
1 Hour

B

Mower Set-up
4 Hours

C

Blade Sharpening
20 Hours

D

Chainsaw Chain and Cutting Bar
5 Hours

SECTION FIVE

POWER EQUIPMENT
30 Hours

A

Hand Held Power Equipment
10 Hours

B

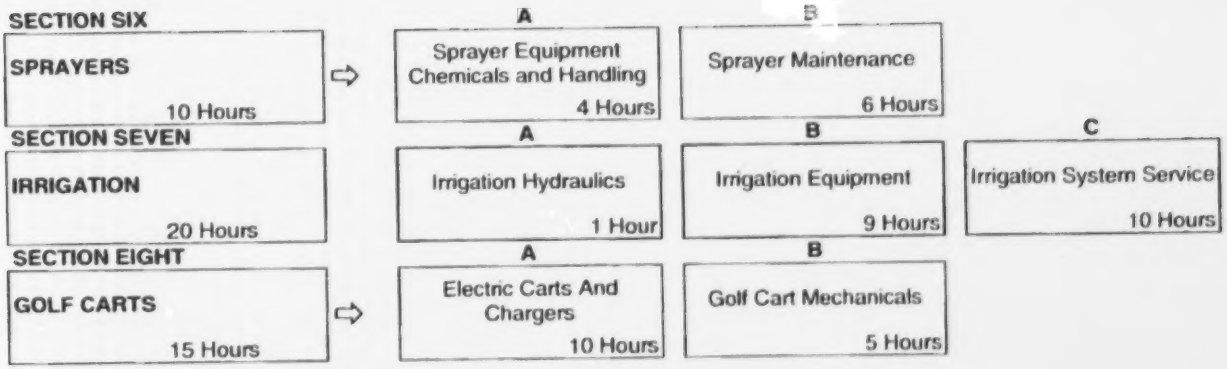
Portable Water Pumps
4 Hours

C

High Pressure Washers
6 Hours

D

Portable Generators
10 Hours



NOTE: The Hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING

OUTDOOR POWER EQUIPMENT TECHNICIAN TRADE
COURSE OUTLINE

SECTION ONE: ..... SAFETY ..... 15 HOURS

A. Safety and Regulations ..... 4 Hours

Occupational Health and Safety Regulations: lectures and procedures

1. Describe personal and equipment safety.
2. Observe safe working habits to prevent accidents.
3. Know what to do in case of an accident.
4. List the sections in the *Occupational Health and Safety* (OH and S) *Act* that apply to the Outdoor Power Equipment Technician trade.

Introduction to Workplace Hazardous Materials Information System (WHMIS)

1. Describe what WHMIS is, its rational and major elements.
2. Define what is meant by a WHMIS label and distinguish between supplier and workplace labels and other means of identification.
3. Describe what is meant by the following classifications:
   a) prohibited product
   b) restricted product
   c) controlled product.
4. Explain what a Material Safety Data Sheet (MSDS) is; its purpose and limitations.
5. Describe the roles, rights and responsibilities of employer, supplier and worker in the education of workers.
6. Report damaged and leaking containers to proper authorities.
7. Other subject areas as deemed appropriate and deliverable by the institution.

Introduction to Transportation of Dangerous Goods Control Act

8. Explain the employer's and employee's responsibility under the TDGC including:
   a) training
   b) handling
   c) shipping
   d) transportation
   e) actions in-case of problems - spills etc.

B. Laws, Liabilities and Legalities ..... 1 Hour

1. Understand the legal ramifications involved in warranties.
2. Identify the technician's legal responsibilities in the servicing or releasing of unsafe vehicles.
3. Know the liabilities when road testing or storing customer's equipment.

C. Fire Prevention and Control.....3 Hours

1. Identify the classes of fires:
   a) class A - ordinary combustibles; wood, paper, packing, etc.
   b) class B - petroleum and synthetic materials; paint, gasoline, etc.
   c) class C - equipment, electrical, internal combustion, etc.
   d) class D - combustible materials, magnesium, etc.
2. Identify the following types of fire extinguishers:
   a) water; stored pressure, cartridge operated, soda acid
   b) carbon dioxide (CO_2)
   c) dry chemical
   d) multi purpose
   e) halon
   f) overhead sprinklers
      i) line storage (wet or dry)
      ii) temperature controlled (loading docks)
   g) fire blankets
3. Know the applications and limitations of fire extinguishers including:
   a) effectiveness in relation to the stage of the fire
   b) procedures and precautions where sprinkler systems are installed.
4. Describe the recommended cycles for fire extinguisher servicing and by whom.
5. Describe procedures and precautions in case of an emergency including
   a) awareness and importance of the:
      i) position and condition of equipment;
      ii) specific assignments of personnel;
      iii) location and operation of alarm systems;
      iv) location, operation and procedures of emergency exits;
      v) fire drills;
      vi) being able and willing to use fire fighting equipment evacuation.
6. Identify potential fire hazards that can be caused by:
   a) accumulations of dust and other kinds of dirt;
   b) faulty wiring and equipment;
   c) leaking containers accumulations of oily trash ;
   d) improper methods of handling flammables;
   e) violations of safety rules and regulations;
      i) storage exit doors
      ii) fire fighting equipment
      iii) fire doors.
7. Identify and describe other hazards associated with a fire outbreak including:
   a) smoke and toxic gas inhalation;
   b) entrapment;
   c) non-functional fire equipment
   d) electrical panels.

D. Storage of Fuels and Solvents .....3 Hours

1. Identify good housekeeping practices for the storage of fuels and solvents.
   a) keep storage areas clean.
2. Identify and use approved storage containers.
3. Clearly mark containers used to store fuels and solvents.
4. Identify and interpret labeling for dangerous goods.

E. Battery Storage and Servicing.....3 Hours

1. Identify battery ratings and determine if wet or dry.
2. Describe battery storage procedures.
3. Demonstrate proper battery handling and filling procedures.
4. Describe battery acid (electrolyte) including:
   a) handling and safety
   b) storage
   c) disposal of old acid and batteries.
5. Demonstrate charging and boosting procedures and precautions.
6. Clean posts and connections and tighten to specifications.
7. Determine battery condition by load testing and with hydrometer test.

F. Use of Compressed Air .....1 Hour

1. Know the hazards of high-pressure air and general safety and maintenance
2. Use proper eye protection.
3. Know how to use air varsol cleaning equipment.
4. Wear safety goggles in the shop at all times.
5. Wear gloves when working with high-pressure air equipment.

SECTION TWO: ..... MACHINE SHOP PRACTICES AND WELDING ..... 45 HOURS

A. Tools .....20 Hours

1. Use the various hand tools used in the trade, such as
   a) wrenches
   b) socket sets
   c) pliers
   d) screwdrivers
   e) hammers
   f) Allen wrenches
   g) snap ring pliers
   h) files
   i) punches and chisels
   j) hack saws
   k) pry bars
   l) impact driver.
2. Use the following electrical testing equipment:
   a) multi-meters, digital and analog
   b) Voltmeters
   c) Ammeters
   d) continuity testers
   e) battery chargers
   f) ignition tester
   g) timing light
   h) tachometer

3. Use the following cleaning tools
   a) degreasing tanks
   b) aerosol tanks
   c) chemical gasket stripper
   d) scrapers
   e) wire wheels
   f) dry blasting

4. Be proficient in the use of the following measuring tools
   a) machinist rules and straight edge
   b) tape measure
   c) outside micrometer
   d) inside micrometer
   e) depth micrometer
   f) calipers - vernier, dial and digital
   g) telescoping gauge
   h) dial indicator
   i) small hole gauges
   j) feeler gauges
   k) compression gauge
   l) vacuum gauge
   m) torque wrench.

5. Identify the following engine service and repair tools
   a) engine stand
   b) valve and valve refinishing equipment
   c) cylinder deglazer
   d) rigid hone and boring bar
   e) stethoscope
   f) valve spring testers
   g) piston ring expanders
   h) bushing and seal installation tools
   i) pullers
   j) crankcase leak tester

6. Identify and use special service tools as required:
   a) by individual
   b) factory service manuals.

7. Identify and use the following tune-up tools:
   a) vacuum gauges
   b) synchronization adjustment wrench
   c) float level gauges
   d) jet wrenches
   e) fuel pressure gauges
   f) valve adjustment tools.

8. Be familiar with, and able to use, the following wheel, suspension and frame service tools:
   a) tire pressure gauges
   b) core tool
   c) hook spanner wrenches
   d) chain breaker
   e) tire irons
   f) strap wrenches
   g) tire changing and balancing tools.

9. Use, and properly care for, power hand tools such as:
   a) electric impact wrenches
   b) air impact wrenches
   c) air ratchets
   d) rotary grinders and buffers
   e) electric drills
      i) drill bits and sharpening procedures.

10. Identify, and use, miscellaneous tools as required in the shop:
    a) taps, dies, drills, and reamers
    b) adjustable small mirrors
    c) magnet pickups
    d) safety glasses and goggles
    e) screw extractors
    f) drill press
    g) spark plug viewer
    h) pin spanner
    i) thread chasers and files
    j) tin snips
    k) flex stone
    l) cotter pin puller
    m) anti-freeze and battery tester

11. Use and maintain the following general shop equipment:
    a) pressure washer - application and usage
    b) air compressor
    c) wet/dry vacuum
    d) propane torch
    e) oxy-fuel torch
    f) lifts and hoists
    g) vises
    h) bench grinder
    i) stone dresser
    j) jacks
    k) oven
    l) hot air gun
    m) plastic welder
    n) shop press.

12. Know the hazards of high-pressure steam.

13. Use cleaning compounds safely.

14. Know how to safely start up and shut down high-pressure washers.

B. Welding.....22 Hours

1. List the general potential safety hazards of welding.

2. Describe the colour coding and special fittings used on oxyacetylene welding/cutting equipment.

3. State the danger in welding, brazing or flame cutting of plated parts (e.g. cadmium or zinc).

4. Describe the harmful rays encountered during welding.

5. Describe safe wearing apparel to be worn during welding/cutting procedures.

6. Describe the precautions to be taken while setting up oxyacetylene equipment include:
    a) backfires
    b) flashback
    c) their prevention

7. Describe the characteristics and safe handling of the gases used for:
    a) oxyacetylene welding and cutting
    b) shielding gases (MIG, TIG, etc.)

8. Describe the following types of electric welding, the equipment and the application:
    a) MIG
    b) TIG
    c) arc

9. Choose the appropriate eye protection, shielding lenses and screening devices to be used while performing the various types of cutting/welding.

10. Wear the appropriate apparel for protection from harmful rays, heat, sparks and hot items.
11. Observe correct and safe procedures for all welding, cutting, heating, etc.
12. Set-up, adjust operate and shut down oxyacetylene regulators, hoses, torch and cutting torch.
13 Braze 16 ga mild steel lap and butt, in the flat position.
14. Use oxyacetylene cutting torch for flame cutting mild steel.
15. Use oxyacetylene cutting torch for heating.
16. Set up MIG welder including:
    a) connect and disconnect shielding gas
    b) adjust gas flow
    c) choose and install correct wire
    d) adjust feed and speed
    e) inspect wires, hoses, tips, wheels, etc. for proper operation and condition
17. Make the following welds in the flat position using the MIG welder on 6mm to 1.2 mm mild steel:
    a) stringer beads
    b) butt
    c) lap
    d) corner & fillet
    e) spot welds

C. Fasteners.....3 Hours

1. Demonstrate fastening and torquing procedures using fasteners.
2. Demonstrate use of other retaining devices (e.g. snap rings, set screws)
3. Demonstrate use of sealers and adhesives common to the trade.

SECTION THREE:..... BASIC ELECTRICAL ..... 30 HOURS

A. Introduction to Electrical Theory.....10 Hours

Electrical terminologies.

1. Know electrical nomenclature.

Ohm's law, volts, amps and ohms.

2. Define and perform Ohm's law calculations.

Conductors and insulators

3. Define conductors and insulators.

Circuit types, series and parallel

4. Identify simple series and parallel circuits.

Shorts, opens and grounds

5. Identify shorts, opens and grounds in simple circuits.

Use of test meters

6. Explain the use of voltmeter, ammeter and ohmmeter.

Power consumption

7. Define power formula (watts).

B. Battery ..... 3 Hours

Construction and materials

1. Explain the construction and operation of the lead-acid battery.

Servicing and testing - new and used

2. Perform recommended battery testing and servicing operations.

Specific gravity

3. Perform specific gravity test.

Recharging, hazards and handling, charging rate 1/10 amp Hour rate

4. Know the proper procedures to handle and charge batteries.

Sulphation

5. Define sulphation.

Freezing precautions

6. Know the precautions to take to prevent freezing.

Storage

7. Describe proper storage procedures.

C. Electrical Circuits ..... 14 Hours

Schematics and symbols

1. Read a schematic and identify the various symbols.

Use of test meters

2. Use the various test meters.

Lighting circuit - testing bulbs, adjustment of brake light switch

3. Identify and test bulbs, lighting and brake circuits.

Basic turn signal circuit

4. Define a basic turn signal circuit.

Horn circuit

5. Define a basic horn circuit

Basic charging circuit

6. Define a basic charging circuit.

Basic starting motor circuit

7. Define a basic starting motor circuit.

Basic ignition circuit

8. Define a basic ignition circuit.

Basic warning and indicator circuits

9. Define the basic warning and indicator circuits.

D. Electrical Wiring.....3 Hours

Soldering

1. Identify types and uses of solders.
2. Identify soldering connectors and wires.

Connectors

1. Identify solderless type connectors.
2. Identify multiple plug connector replacement.

Wires

1. Select proper gauge.
2. Replace wires in conduit.

Fuses and circuit breakers

1. Select proper fuses for accessories and loads.

SECTION FOUR: ..... BEARINGS AND SEALS ..... 10 HOURS

A. Bearings .....5 Hours

1. Identify types of bearings and common applications of these bearing types in the trade:
   - a) plain;
     - i) bushings
     - ii) babbit
     - ii) insert
   - b) antifriction;
     - i) ball
     - ii) roller
     - iii) needle
     - iv) roller
     - v) taper roller
     - vi) thrust.
2. Describe axial and radial loads and how load characteristics are used to select bearing types.
3. Describe a one way bearing (sprag).
4. Describe removal and replacement of various bearing types.
   - a) demonstrate correct adjustment of a bearing.
   - b) diagnose common bearing failures.

B. Seals ..... 5 Hours

1. Describe static and dynamic seals
2. Identify the following static seals:
   a) O ring
   b) gasket
   c) sealant
   d) quad rings.
3. Identify the following dynamic seals:
   a) mechanical
   b) labyrinth
   c) piston ring
   d) ceramic.
4. Describe removal and replacement of various seal types.
5. Diagnose and describe common seal failures.

SECTION FIVE: ..... COMMUNICATION AND MANUALS ..... 20 HOURS

A. Service Manuals ..... 5 Hours

1. Find service information using a printed service manual.
2. Find service information using a microfiche system.
3. Find service information using a computer (online and compact disc).

B. Basic Parts ..... 5 Hours

1. Identify and obtain required parts in a printed manual.
2. Find parts information using a microfiche system.
3. Find parts information using a computer online or from a compact disc.

C. Customer Service ..... 5 Hours

1. Identify different approaches used to implement quality customer service:
   a) retail customers
   b) wholesale customers
   c) internal customers
   d) distribution customers
   e) personal contact service customers
   f) electronic contact service customers (telephone, fax, EDI).
2. Identify the costs of retaining customers and the costs involved in gaining new customers.
3. Identify techniques that will improve effective customer interaction during difficult customer situations:
   a) angry customers
   b) impatient customers
   c) indecisive customers
   d) other.
4. Techniques for recovery of lost customers.

D. Work Orders ..... 5 Hours

1. Identify the Information required to complete an engine information form.
2. Complete work orders--parts/labour/misc.
3. Enter work and parts used on a work order.
4. Prepare an estimate.
5. Complete an engine evaluation form.

SECTION SIX: ..... ASSEMBLY AND PRE-DELIVERY ..... 30 HOURS

A. Unloading and Uncrating ..... 5 Hours

1. Proper use of materials handling equipment
2. Use proper lifting devices to load and unload equipment.
3. Check incoming shipments and wherever possible:
   a) check for obvious visual damage
   b) if crate is damaged, uncrate in presence of freight hauler and note damage on delivery slip.

B. Forklift Operation ..... 5 Hours

1 Describe forklift trucks used in power equipment shops and yards.

2 Describe safe use and application of forklift trucks

3 Describe forklift truck design principles and capacities;
   (a) types of fuel
   (b) types of tires
   (c) specialized applications
   (d) fork lift accessories for power equipment
   (e) indoor trucks
   (f) outdoor trucks

C. Parts Component List ..... 5 Hours

1. Uncrate and note missing or duplicate parts.

D. Assembly ..... 10 Hours

1. Assemble new equipment and machines being careful to:
   a) follow instructions explicitly
   b) ensure proper routing or cables and wiring.

E. Manufacturer's P.D.I. Checklist ..... 5 Hours

1. Perform pre-delivery inspections as per manufacturer's specifications. May include but not restricted to checking
   a) all oil levels
   b) coolant level and specific gravity if applicable
   c) activate battery, check electrolyte level and specific gravity
   d) drive chain or belt adjustment if applicable
   e) wheel nut torque

f) brake and clutch adjustment
g) tire pressure.

2. Preparation for storage:
   a) fuel
   b) batteries.

3. Repair minor cosmetic damage.

SECTION SEVEN:..... WHEEL HUBS AND TIRE MAINTENANCE..... 30 HOURS

A. Types of Wheels .....1 Hour

1. Identify the types of wheels used in industry.

B. Wheel Inspection .....2 Hours

1. Know how to do a proper wheel inspection.
2. Check for damaged bearings and dust seals.
3. Check wheel and hub for dents, cracks, damaged threads and corrosion.
4. Measure run out.

C. Wheel Servicing .....10 Hours

1. Describe the following terms: caster, camber, toe in, and toe out.
2. Perform a complete wheel servicing including the following:
   a) remove and replace wheel bearings
      i) method of cleaning and checking for damaged bearings
      ii) lubricants
   b) replace rim or hub.
3. Check and adjust utility or boat trailer wheel alignment.

D. Tires .....1 Hour

1. Identify tire application, sizes and designs.

E. Tire Changing.....16 Hours

1. Change tires properly by:
   a) demounting, use of tire irons and tire changers
   b) tire inspection
      i) punctures
      ii) cracks
      iii) foreign material
      iv) uneven tread wear
      v) out of balance
      vi) other
   c) repair a flat tire (tube and tubeless type)
   d) remount and directional indication if applicable
   e) balance tire and wheel assembly

SECTION EIGHT: ..... BRAKES ..... 30 HOURS

A. Nomenclature ..... 1 Hour

1. Describe names and locate brake systems and their components:
   a) mechanical
   b) hydraulic
   c) electric

B. Hydraulic Theory ..... 2 Hours

Pascal's law

1. Explain Pascal's law.

Brake fluid designations and specifications

2. Name the types of brakes fluids and describe their limitations:
   a) fluid and seal compatibility

Hygroscopicity

3. Define hygroscopicity.

C. Brake Design ..... 1 Hour

1. Define the following brake designs:
   a) drum brakes
   b) disc brakes - internal and external (latest designs)
   c) electric brakes.

D. Brake Inspection, Maintenance and Repair ..... 12 Hours

3. Inspect, maintain and repair brakes as follows:
   a) drum brakes - hydraulic and mechanical
      i) brake lever, pedal and return springs
      ii) brake cables and rods, clevises and linkages
      iii) brake light switches
      iv) brake cam arm, spindle and backing plate
      v) cleaning procedures – asbestosis
      vi) clean and inspect all internal parts
      vii) check drum wear
      viii) reline brake shoes
      ix) hydraulic system inspection and repair
      x) reassembly procedures
   b) disc brakes - mechanical and hydraulic
      i) check calipers mounting brackets
      ii) check master cylinder linkage and fluid level
      iv) wheel bearings and dust seals
      v) brake wiring and switches
      vi) brake pads thickness
      vii) brake disc
      ix) hoses and lines.

E. Changing and Bleeding Brake Fluid and Hoses ..... 1 Hour

1. Change brake hoses and demonstrate the proper procedure to bleed brake systems.

F. Master Cylinder, Caliper and Wheel Cylinder Rebuilding ..... 11 Hours

1. Rebuild the following:
   - a) master cylinder
     - i) remove and dismantle
     - ii) clean and inspect all parts
     - iii) measure for wear and return spring length
     - iv) replace parts as required
     - v) reassembly master cylinder
   - b) caliper
     - i) remove and dismantle
     - ii) clean and check all parts
     - iii) measure for wear
     - iv) replace parts as required
     - v) reassembly caliper
   - c) wheel cylinder
     - i) remove and dismantle
     - ii) clean and check all parts
     - iii) measure for wear
     - iv) replace parts as required
     - v) reassembly wheel cylinder

G. Construction, Operation, and Design Features of Electric Brake Systems ..... 2 Hours

1. Identify electric brake failures.
2. Inspect and repair trailer electric brake wiring

SECTION NINE: ..... ENGINE THEORY OF 2 AND 4 STROKE ENGINES ..... 30 HOURS

A. Two Stroke ..... 15 Hours

1. Define the following basics of two stroke engines:
   - a) theory
   - b) fuel oil mixtures
   - c) port timing
   - d) piston port
   - e) reed valve
   - f) rotary valve
   - g) variable exhaust port timing
   - h) crankcase sealing
   - i) single and multi-cylinder engines
   - j) piston and ring design
   - k) transfer cutouts (piston and cylinder)
   - l) types of cylinder materials and sleeves
   - m) compression ratios
   - n) squish bands.

B. Four Stroke.....15 Hours

1. Describe the following four stroke engine types, application and advantages, disadvantages:
   a) theory
   b) valve train
   c) side valve
   c) overhead valve push rod
   d) single overhead camshaft
   e) double overhead camshaft
   g) camshaft designs and driving systems
   h) single and multi-cylinder engines
   i) cylinder design
   j) piston design
   k) piston ring design
   l) combustion chamber design
   m) compression ratios
   n) piston to cylinder head clearance.

SECOND PERIOD TECHNICAL TRAINING

OUTDOOR POWER EQUIPMENT TECHNICIAN TRADE
COURSE OUTLINE

Due to the nature of the work of the Outdoor Power Equipment Technician, it is imperative that safety be taught on a continuous basis throughout the entirety of this course.

Special emphasis should be placed on weak areas of theory and lab, which are evident from progressive tests and examinations administered throughout the course. The time required for such examinations and testing shall be allowed for in each area of instruction.

SECTION ONE: ..... FRAMES AND SUSPENSIONS ..... 6 HOURS

A. Frame Types and Materials ..... 1 Hour

1. Identify the types of frames and materials
   a) ferrous and non ferrous alloys
   b) tubing
   c) castings
   d) fabricated sheet.

B. Suspension Types ..... 5 Hours

1. Identify front and rear suspension types.
2. Describe the purpose of suspensions.
3. Describe sprung and unsprung weight.
4. Describe solid axle and independent suspensions.
5. Describe spring construction:
   a) coil
   b) leaf
   c) torsion
   d) air.
6. Describe shock absorber operation.

SECTION TWO: ..... FUEL SYSTEMS ..... 45 HOURS

A. Induction System ..... 5 Hours

1. Describe naturally aspirated intake systems.
2. Describe the effect of intake length in relation to engine performance and design.
3. Explain the function of and perform service procedures for common types of air cleaners.
4. Describe the purpose and design features of intake manifolds.
5. Describe forced air induction:
   a) turbo chargers
   b) super chargers.
6. Describe the parts, construction and operating principles of turbo changers.
   a) identify maintenance needs and service procedures of a turbo charger.

7 Describe the parts, construction and operating principles of super chargers.
   a) identify maintenance needs and service procedures of a super charger.

B. Fuel ..... 2 Hours

1. Describe fuels used in power equipment
   a) gasoline
   b) diesel
   c) LPG (propane)
   d) alcohol / gasohol
   e) kerosene.
2. Describe fuel quality and safety pertaining to fuel storage for
   a) gasoline
   b) diesel
   c) LPG (propane)
   d) alcohol / gasohol
   e) kerosene.
3. Explain construction and operation of fuel tanks, lines and filters for the following fuel types
   a) gasoline
   b) diesel
   c) LPG (propane)
   d) alcohol / gasohol
   e) kerosene.
4. Describe service procedures for high-pressure fuel delivery systems
5. Describe considerations for alcohol based fuels pertaining to
   a) Water absorption
   b) Compatibility with components or materials found in some fuel delivery systems.

C. Pumps and Supply ..... 3 Hours

1. Explain the purpose, construction and operation of fuel pumps:
   a) mechanical
   b) electrical
   c) pulsation.
2. Explain the safety devices employed in a fuel system.
3. Test and diagnose fuel pump problems and their associated components.

D. Carburetor ..... 15 Hours

1. Explain how a simple carburetor works, describing the role of the following components
   a) venturi
   b) jets
   c) float
   d) throttle.
2. Describe carburetor types found in power equipment, including:
   a) butterfly
   b) slide
   c) constant velocity
   d) diaphragm
   e) side draft
   f) down draft.

3. Describe carburetor circuits and components of each:
   a) float – fuel delivery
   b) idle
   c) off idle
   d) intermediate
   e) open or high speed circuit
   f) low speed – high speed diaphragm carburetor circuits.

4. Inspect settings, set up and adjust the following carburetor types:
   a) float type
   b) diaphragm type.

E. Electronic Fuel Injections ..... 10 Hours

1. Describe the basic principles of electronic fuel injection including:
   a) basic components common to EFI systems
   b) multiport vs. single point delivery
   c) explain the speed density and mass air flow of air measurement and identify the fuel injection system where each is used
   d) explain purpose and operation and location of fuel injectors
   e) explain why and how air fuel mixtures are altered for various engine operating conditions
   f) explain purpose, construction, location and operation of various air mass measuring devices

2. Describe how an integrated electronic engine management system can control EFI, ignition advance, charging systems. emissions, interlock systems, engine RPM, and other systems (e.g. ABS, - active suspension)

3. Identify and describe the following fuel injection system types:
   a) Ficht
   b) Orbitol
   c) HPDI.

4. Diagnose various EFI systems. Using the following:
   a) OEM error codes
   b) scan tools
   c) standard electrical test equipment, such as VOMs or test lights
   d) built in OEM scan tests.

5. Test system pressure, operation of fuel delivery system.

F. Diesel ..... 10 Hours

1. Describe compression ignition and the types of diesel engines found in power equipment

2. Describe the operation of glow plugs and preheaters.

3. Explain the fundamental operation and design features of diesel fuel injection systems and related components.
   a) lines and fittings
   b) filters
   c) pumps.

4. Describe the diesel injector.

5. Remove test and install diesel fuel injectors (bleed system).

6. Remove air trapped in a diesel fuel system (bleed system).

7. Remove, inspect, install and time diesel pump.

SECTION THREE:.....IGNITION SYSTEMS..... 40 HOURS.

A. Flywheel Magneto Ignition .....10 Hours.

1. Describe the principles of the magneto ignition system..
2. Identify the components of the magneto ignition system..
3. Describe theory of operation of the magneto:
   a) points system
   b) solid state system.
4. Test magneto operation.
5. Service magneto
6. Set timing.
7. Inspect, recondition, replace, adjust points and condenser if applicable.

B. Mechanical and Electronic Ignition Systems .....15 Hours

1. Describe the operation of a points or breaker-less inductive coil ignition system.
2. Describe the purpose of spark advance.
3. Describe method for controlling spark advance:
   a) mechanical
   b) electronic
   c) computer.
4. Describe solid state ignition systems:
   a) capacitor discharge systems/switched systems
   b) inductive coil ignition systems
   c) computer managed ignition systems.
5. Describe and locate electronic sensors and pickups.
6. Service ignition components:
   a) distributors
   b) points
   c) pickup/sensors
   d) coils
   e) modules
   f) connections, wiring.

C. Ignition, Kill, Interlock and Interlock Switch Systems .....10 Hours

1. Describe ignitions and starting systems interlocks:
   a) mechanical
   b) electrical.
2. Test and repair ignitions systems and interlocks.
3. Describe legal and liability issues of disabling or modifying interlock systems.

D. Spark Plugs, Wires and Caps ..... 3 Hours

1. Describe spark plug construction.
2. Describe and identify spark plug heat range.
3. Clean adjust and test spark plug.

E. Testing and Troubleshooting ..... 2 Hours

1. Troubleshoot an ignition system, identify and correct no spark condition.

SECTION FOUR: ..... CHARGING SYSTEMS ..... 20 HOURS

A. Alternators ..... 20 Hours

1. Describe alternator theory of operation:
   a) permanent magnet single phrase
   b) permanent magnet three phrase
   c) electromagnetic rotor three phase
   d) regulation systems.
2. Identify components and location of components.
3. Perform tests on charging system including the following components:
   a) stator
   b) rotor
   c) rectifier assembly
   d) slip ring and brushes
   e) regulators
   f) integrated charging system control modules.
4. Troubleshoot faults and assess need to replace or overhaul alternators or components.
5. Identify outputs, open and short circuits, grounding in wiring.

SECTION FIVE: ..... STARTING SYSTEMS ..... 30 HOURS

A. Starters ..... 30 Hours

1. Describe starter theory operation:
   a) rewind
   b) electric
      i) battery operated
      ii) 110 volts.
2. Describe types of drives.
3. Describe types of circuits:
   a) key
   b) solenoid
   c) relay
   d) ignition by-pass.
4. Identify starting system components.
5. Disassemble, assess condition clean, lubricate, recoil starter.

6. Remove, inspect and replace electric starter.

Troubleshoot starter system

1. Troubleshoot starting systems, include the following tests or procedures
   a) amp draw
   b) voltage drop
   c) rpm
   d) operation of switches, solenoids

SECTION SIX:.....EXHAUST AND GOVERNORS..... 10 HOURS

A. Exhaust.....4 Hours

1. Describe the purpose and function of an exhaust system
2. Describe the operation and requirement for the following exhaust components, including legal or liability concerns:
   a) mufflers
   b) spark arrestors
   c) catalytic converters.
3. Describe two cycle exhaust systems:
   a) tuned exhaust
   b) expansion chamber.
4. Describe four cycle exhaust systems:
   a) dry
   b) wet

B. Governors.....6 Hours

1. Describe types of governor control:
   a) air vane
   b) mechanical.
2. Adjust engine governor for:
   a) load rpm
   b) no load rpm.

SECTION SEVEN:..... COOLING SYSTEMS ..... 18 HOURS

A. Air Cooling .....2 Hours

Air Cooled engines

1. Describe principles of heat transfer.
2. Describe air-cooling systems including:
   a) engine finning
   b) fans and shrouding.
3. Service air cooling components including:
   a) fins
   b) fans
   c) air shrouding and components.

B. Liquid Cooling.....10 Hours

1. Describe liquid cooling systems including:
   a) principle of operation
   b) radiator operation – construction materials
   c) coolants, ratios, corrosions and inhibitors
   d) thermostats
   e) water pumps
   f) fans, direct drive, thermostatic and electric.
2. Inspect, troubleshoot, repair, liquid cooling components including:
   a) pressure
   b) thermostat operation
   c) flush and refill
   d) water pump operation
   e) condition of hoses and or passageways.

C. Oil Cooling.....6 Hours

1. Describe oil cooling / heat exchangers and their applications including
   a) engine oil cooler
   b) transmission oil cooler
   c) power steering or hydraulic oil cooler
   d) external lines and fittings.
2. Inspect, replace or repair oil cooling components.

SECTION EIGHT:..... LUBRICATION SYSTEMS ..... 12 HOURS

A. Oils.....1 Hour

1. Describe lubrication and the role of oil in cooling and the removal of wear particles.
2. Describe the lubrication requirements of bearings gears and sliding parts including:
   a) plain bearings
   b) frictionless bearings
   c) gear teeth
   d) pistons, cylinders.
3. List and briefly describe power equipment lubrication requirements including:
   a) engine
   b) transmissions/gear cases/differentials
   c) suspensions
   d) drive components
   e) auxiliary drive components
   f) cables control rods etc.
4. Identify types and grades of oils, greases, other lubricants by – API and SAE classification.
5. Describe the meaning of viscosity ratings and oil service conditions and classifications.

B. Oil Pumps ..... 2 Hours

Oil pumps

1. Identify and the following oil circulation systems:
   a) splash
   b) gear
   c) piston
   d) trochoid.
2. Describe oil pressure requirements for engine components:
   a) plain bearing
   b) frictionless bearing
   c) sliding parts
   d) high load vs. low load.
3. Distinguish between wet and dry sump lubrication systems.
4. Test oil pressure.

C. Filtration Systems ..... 3 Hours

1. Describe the operation of oil filters including:
   a) full and partial flow
   b) bypass system
   c) element construction
   d) centrifugal.
2. Locate, remove replace or clean the following filter types:
   a) removable - disposable
   b) centrifugal
   c) magnetic drain plug, other.

D. Lubrication Circuits ..... 3 Hours

1. Identify and service the following lubrication circuit valves:
   a) relief valves
   b) bypass valves
   c) metering orifices.

E. Two-stroke Lubrication ..... 3 Hours

1. Describe two-stroke lubrication:
   a) premix ratios
   b) injector systems
   c) injector pump operation and adjustment.

SECTION NINE: .....TUNE-UP AND TROUBLESHOOTING..... 59 HOURS

A. Air Filters .....1 Hour

1. Identify the various types of air filters and state how each is serviced:
   a) paper
   b) foam
   c) oil bath
   d) mesh – other.
2. Evaluate filter condition service or replace where applicable.

B. Engine Compression .....3 Hours

Use of compression gauge

1. Use a compression gauge to evaluate engine condition.
2. Perform wet and dry compression tests.

Leak down tests

1. Perform leak down tests.

C. Tune up and troubleshooting .....55 Hours

Examine spark plugs

1. Be able to assess the following by reading spark plugs:
   a) carburetion
   b) oil consumption
   c) overheating
   d) detonation – pre-ignition
   e) engine/cylinder operating properly.

Visual inspection

2. Perform visual inspection of engine assess for signs of damage, wear, leakage etc.

Troubleshooting

3. Describe the three essential requirements for engine operation:
   a) compression
   b) fuel
   c) ignition.
4. For an engine that will not run, verify compression, fuel and ignition.
5. For an engine where a compression, fuel or ignition problem has been isolated, use a systematic approach to isolate and describe the fault.
6. For an engine that is running poorly, verify whether the problem is compression, fuel or ignition.
7. For an engine that is running poorly and the problem has been identified as being compression, fuel or ignition, use a systematic approach to isolate and describe the fault.
8. For a non-running engine or poorly running engine where the fault has been isolated to ignition or carburetion, make required repair or replacement.

Tune up

1. For an engine with compression, fuel system and ignition operating within acceptable limits, check and adjust where appropriate:
   a) ignition timing
   b) carburetor settings
   c) engine idle speed.
   d) governor settings
   e) control linkages
   f) sensor condition, operation where applicable.

THIRD PERIOD TECHNICAL TRAINING

OUTDOOR POWER EQUIPMENT TECHNICIAN TRADE
COURSE OUTLINE

Due to the nature of the work of the Outdoor Power Equipment Technician, it is imperative that safety be taught on a continuous basis throughout the entirety of this course.

Special emphasis should be placed on weak areas of theory and lab which are evident from progressive tests and examinations administered throughout the course. The time required for such examinations and testing shall be allowed for in each area of instruction.

SECTION ONE: ..... HYDRAULICS ..... 80 HOURS

A. Hydraulic Basics ..... 6 Hours

Safety

1. State the safety precautions that must be observed when working with hydraulics

Basic principles of hydraulics

1. Explain hydraulic principles of pressure, force, area, volume, power, and flow rate cycle times using mathematical calculations.
2. Draw and interpret basic hydraulic schematics.
3. Describe the operation of closed loop and open loop hydraulic systems as found in outdoor power equipment.
4. Identify the components found in open loop and closed loop hydraulic systems.

B. Pumps and Motors ..... 12 Hours

1. Explain basic hydraulic principles related to hydraulic pumps.
2. Explain the principles of operation and application of a typical gear pump.
3. Explain the principles of operation and application of a typical piston type hydraulic pump.
4. Explain the principles of operation and application of a typical vane pump.
5. Explain the principle of gear, vane and piston hydraulic motors.
6. Explain the operation and application of a typical gear, vane, and piston hydraulic motors.
7. Remove, disassemble, inspect, reseal, repair, and replace components of hydraulic motors

C. Cylinders ..... 12 Hours

1. Explain the operation and applications of basic hydraulic cylinders:
   a) double acting
   b) single acting
   c) balanced
   d) unbalanced.
2. Dismantle, inspect, reseal, and re-assemble hydraulic cylinders.

D. Lines ..... 1 Hour

1. Describe hydraulic lines fittings and couplers.
2. Perform visual inspection of lines, fittings, and couplers.
3. Describe pressure ratings and classifications of lines fittings and couplers.
4. Identify high pressure and low-pressure lines fittings and couplers.

E. Hydraulic Fluids ..... 1 Hour

1. Explain properties of hydraulic fluid and criteria of its selection.
2. State the functions of the hydraulic reservoir and its related components.
3. State the function and principles of operation of filtration devices.
4. State the function and application of hydraulic heat exchangers.

F. Control Valves ..... 3 Hours

Directional, flow:

1. Explain the principles and applications of basic hydraulic control valves:
   a) spool valve
   b) check valve
   c) shuttle valve
   d) manual valve

G. Pressure Valves ..... 3 Hours

1. State the function and principles of operation of:
   a) direct acting pressure valve
   b) pilot control valves.

H. Testing ..... 42 Hours

Pressure

1. Use a systematic procedure to diagnose common faults in a simple hydraulic system
2. Identify the cause and common failures of hydraulic system components
3. Assess performance and troubleshoot components of a basic hydraulic system

Flow

1. Use systematic procedures to diagnose common faults
2. Test a complete hydraulic system

SECTION TWO: ..... BASIC DRIVES ..... 60 HOURS

A. Gear and Drive Ratios ..... 3 Hours

1. Explain the need for reduction ratios in terms of the relationship of torque and power.
2. Calculate gear sprocket and pulley ratios.
3. Describe the effect on rotation of selecting gears or sprockets and pulleys to transmit rotary motion.

B. Belt Drives ..... 3 Hours

1. Describe various belt drive systems found in power equipment:
   a) construction
   b) sizing application.
2. Inspect, adjust, align and tension a belt drive.
3. Diagnose belt drive failures.

C. Chain Drives ..... 3 Hours

1. Describe the chain drive types found in power equipment:
   a) Roller
   b) O ring roller
   c) Hyvo (silent).
2. Describe chain and sprocket sizing convention.
3. Describe lubrication requirements for each chain type.
4. Describe chain connectors:
   a) endless
   b) riveted
   c) master link
   d) cranked links
   e) chain breakers.
5. Remove, install and align chain and sprockets.
6. Remove and install:
   a) master link (conventional roller and O ring)
   b) riveted link
   c) endless chain.
7. Inspect installed chain and sprocket condition.
8. Adjust for tension and check chain alignment.

D. Clutches ..... 20 Hours

Single and multiplate (wet or dry)clutches

1. Explain operation and principles of a clutch.
2. Explain the construction, design features and function of a single and multiplate clutch.
3. Adjust a clutch assembly.
4. Diagnose problems related to clutch assembly.

5. Disassemble inspect, and re-assemble clutch:
   a) multiplate
   b) single plate
   c) electric clutch.

Electrical

1. Describe the operation of an electromagnetic clutch.
2. Disassemble, inspect and reassemble electric clutches, wheel cylinder

Centrifugal and Variable Ratio clutches

1. Describe the operation of a centrifugal clutch.
2. Disassemble inspect and reassemble a centrifugal clutch.
3. Describe the operation of a variable ratio clutch including:
   a) principles of operation
   b) torque multiplication.
4. Disassemble, inspect and reassemble a variable ratio clutch and wheel cylinder.

E. Transmission ..... 20 Hours

Transmission and components

1. Define gear terminology.
2. Identify the gear types found in power equipment and describe their applications.
3. Identify gear tooth types and applications.
4. Describe gear tooth contact patterns.
5. Describe shift mechanisms:
   a) synchromesh and non synchromesh
   b) constant mesh.
6. Describe shift selection types:
   a) linear
   b) non linear
   c) selector forks
   d) rotary selection
   e) gear dogs.
7. Disassemble inspect and re-assemble a basic transmission

F. Fluid Drives ..... 3 Hours

1. Define fluid drives.
2. Explain function and operating principles.
3. Describe the components of a fluid drive
4. Disassemble and assemble basic fluid drive.

G. Differentials ..... 6 Hours

1. Describe the purpose and function of differentials.
2. Explain differential operations.
3. List differential components.
4. Inspect and adjust differential.

H. Drive Shafts and Universal Joints ..... 2 Hours

Drive shafts

1. List drive shaft and PTO types and their components.
2. Service and repair drive shaft assemblies.

Universal joints

1. State the function of universal joints.
2. Identify the parts of a universal joint.
3. List types of PTO power transmitting devices.
4. Distinguish between types of PTO shafts.
5. Describe the operation of the universal joint and the constant velocity universal joint.
6. Diagnose and repair driveline vibration problems.
7. Disassemble, inspect, and service a single cardon type universal joint.

SECTION THREE: ..... ENGINE OVERHAULS ..... 95 HOURS

A. Engine Failures ..... 2 Hours

1. Diagnose engine failures including but not restricted to:
   a) operator interview
   b) visual inspection
   c) compression tests
   d) leak down tests
   e) mechanical inspections
   f) determine cause.
2. Prepare estimates of parts, labor and sublet repairs, where applicable, prepare repair options for customer.

B. Measurement and Inspection ..... 30 Hours

1. Disassemble engine, inspect and measure the following components to factory wear specifications:
   a) cylinder
   b) crank shaft
   c) piston
   d) rings.
   e) head and valve train
   f) connecting rod
   g) bearings.

44

C. Recondition Parts ..... 20 Hours

1. Describe the purpose of factory specified operating clearances for the following components.
   a) cylinders.
   b) crankshaft
   c) pistons and rings.
   d) heads and valve train.
   e) connecting rod
   f) bearings
2. Describe how engine design and purpose effects specified clearances.
3. Describe total allowable wear limits.
4. Describe economic considerations for replacing worn components with new parts, reconditioned parts, reconditioning the parts in the shop, or replacement with a new unit.
5. Perform the following reconditioning procedures for applicable engine type where the procedure is appropriate:
   a) hone cylinder
   b) check and adjust piston ring end gap
   c) grind and lap valve
   d) replace valve seat
   e) cut valve seat
   f) resize connecting rod
   g) surface a head.
6. Describe piston knurling.

D. Reassembly of Engines ..... 40 Hours

1. Re-assemble engine.
2. Describe why cleanliness is essential for reassembly.
4. Fit Pistons and rings, hone cylinders.
5. Describe the purpose of assembly clearance and why clearances might vary for different engine types or manufacturers.
6. Assemble Cranks and connecting rods, check for proper clearance and fit.
7. Plain insert bearing bottom end type.
8. Inspect new roller bearing bottom end for fit and clearance.
9. Assemble valves springs and spring keepers, assemble valve train.
10. Replace -reassemble seals and O-rings.
11. Perform final assembly of engine and related components, lubricants and coolants initial adjustments, as required.

E. Testing of Rebuilt Engine and Final Adjustments ..... 3 Hours

1. Do an inspection and start up of newly assembled engine.
2. Perform running adjustments, synchronization.
3. Test and evaluate the newly assembled engine under operating conditions or an adequate simulation.

SECTION FOUR ..... ADVISORY NETWORK AND COACHING SKILLS ..... 5 HOURS

A. Advisory Network And Coaching Skills.....5 Hours

1. Describe the following coaching skills used for training apprentices:
   a) identify the point of lesson
   b) link the lesson
   c) demonstrate a skill
   d) provide opportunity to practice a skill
   e) give feedback to learner
   f) assess the learner's progress.

2. Describe the role and purpose of the advisory network and the Provincial apprenticeship Committee for the Outdoor Power Equipment Technician trade.
   a) promote apprenticeship training

FOURTH PERIOD TECHNICAL TRAINING

MARINE AND RECREATION OUTDOOR POWER EQUIPMENT TECHNICIAN COMBINED COURSE OUTLINE

SECTION ONE ..... FUEL SYSTEMS ..... 30 HOURS

A. Marine Fuel Systems ..... 1 Hour

1. Describe marine fuel supply systems.
2. Describe safety issues for marine fuel systems.
3. Describe bilge venting systems.
4. Describe anti siphon valves.
5. Test marine fuel system operation:
   a) vacuum
   b) pressure
   c) air leak test.
6. Describe marine fuel pumps.

B. Advanced Carburetion ..... 2 Hours

1. Describe typical ATV marine and snowmobile carburetors.
2. Describe constant velocity (CV) carburetors.
3. Compare CV carburetor operation to conventional slide carburetor operation.
4. Describe the following carburetor types:
   a) Rochester and Holley two barrel
   b) Rochester, Weber and Holley four barrel.
5. Describe outboard proprietary butterfly carburetors.

C. Carburetor Troubleshooting ..... 10 Hours

1. Describe how carburetor faults are isolated.
2. Describe how a carburetor fault is determined and the steps required to solve the problem including:
3. Adjust and troubleshoot:
   a) Holley and Rochester two barrel
   b) Holley Rochester and Weber four barrel
   c) Mikuni round slide, flat slide, CV, butterfly Super BM
   d) Keihin round slide, flat side, CV, butterfly
   e) Proprietary outboard butterfly.
4. Synchronize multiple carburetors using various techniques.

D. Jetting Principles ..... 2 Hour

1. Describe why jetting modifications are made.
2. Describe the procedure for making and evaluating changes to jetting.
3. Describe initial carburetor set up:
   a) new OEM replacement or rebuilt or serviced carburetor set up
   b) non OEM replacement type set up
   c) new OEM different carburetor type set up.
4. Describe how to evaluate initial settings and make adjustments for optimal performance:
   a) piston wash
   b) plug reading.
5. Describe function and installation of a pyrometer.
6. Describe how to use pyrometer readings to evaluate jetting.
7. Describe Dial A Jet / Power Jet function and installation.
8. Describe altitude compensators and DPM.
9. Troubleshoot altitude compensator and DPM.

E. Oil Injection ..... 3 Hours

1. Trouble shoot disassemble, assemble, set up and test oil injection system:
   a) Mikuni
   b) VRO.

F. Advanced Fuel Injection ..... 12 Hours

1. Describe:
   a) lift pumps
   b) vapour separators
   c) high pressure pumps
   d) regulators
   e) battery-less fuel injection systems.
2. Test and troubleshoot:
   a) outboard EFI
   b) direct injection
   c) recreation EFI
   d) testing /troubleshooting
   e) stern drive EFI.

SECTION TWO ..... IGNITION SYSTEMS ..... 25 HOURS

A. Marine And Recreation Ignition Systems ..... 25 Hours

1. Describe Marine and Recreation ignition system considerations:
   a) electronic reverse
   b) idle stabilizers
   c) high speed spark advancers
   d) ois
   e) cdm ignition

f) engine protection systems
g) digitally controlled ignition
h) other.

2. Test and troubleshoot Marine and Recreation ignition components:
   a) electronic reverse
   b) idle stabilizers
   c) high speed spark advancers
   d) OIS
   e) CDM ignition
   f) engine protection systems
   g) digitally controlled ignition
   h) other.
3. Adjust digital (programmable) timing.
4. Describe throttle safety switches.
5. Describe digital keyless security systems.
6. Test and adjust throttle safety switch.
7. Program digital key.
8. Troubleshoot digital keyless system.
9. Describe stern drive distributor and distributor-less ignition systems.
10. Troubleshoot test and adjust stern drive ignition systems.

SECTION THREE..... MARINE GEAR HOUSINGS ..... 25 HOURS

A. Shifting ..... 2 Hours

1. Describe various marine shift mechanisms:
   a) electric shift
   b) mechanical shift
   c) cone clutch
   d) adjust shift mechanisms.

B. Shimming ..... 20 Hours

1. Describe marine shimming procedures:
   a) pinion height
   b) forward gear lash
   c) reverse gear lash
   d) end float.
2. Perform marine shimming procedure on various gear housings.

B. Transom Plates ..... 3 Hours

1. Describe transom plate service procedures:
   a) alignment
   b) drive installation.

SECTION FOUR.....JET DRIVES.....10 HOURS

A. Pumps.....2 Hours

1. Describe pump types:
   a) mixed flow
   b) axial flow
   c) outboard pumps.
2. Describe jet drive components:
   a) intake grate
   b) impeller
   c) wear ring
   d) stator
   e) nozzle.

B. Jet Drive Maintenance.....8 Hours

1. Perform maintenance and adjustment:
   a) impeller clearance
   b) shift mechanism
   c) bearings
   d) alignment
   e) troubleshooting.
2. Describe jet drive performance accessories:
   a) grates
   b) impellers
   c) trim.
3. Install and troubleshoot jet drive performance accessories.

SECTION FIVE.....POWER TRIM.....20 HOURS

A. Power Trim.....20 Hours

1. Describe trim limit methods.
2. Troubleshoot trim limit.
3. Describe power trim components used by various manufacturers.
4. Describe Marine power trim operation.
5. Test and Troubleshoot Marine power trim systems.

SECTION SIX ..... PROPS AND HULLS ..... 10 HOURS

A. Props .....6 Hours

1. Describe prop characteristics and operation:
   a) pitch
   b) diameter
   c) rake
   d) cupping
   e) slip.
2. Describe materials used for props:
   a) aluminum
   b) steel
   c) brass/bronze
   d) composite
3. Describe prop design:
   a) number of blades
   b) blade shape
   c) blade size
   d) hub type.
4. Describe prop troubleshooting:
   a) cavitation
   b) ventilation
   c) slip calculation
   d) speed calculation.

B. Hulls .....4 Hours

1. Describe hull design and terminology:
   a) transom angles
   b) bottom configuration
   c) materials.
2. Describe handling problems:
   a) hull defects
   b) engine height
   c) torque problems
   d) speed loss.

SECTION SEVEN.....RECREATION DRIVE TRAINS ..... 30 HOURS

A. Recreational Clutches .....20 Hours

1. Describe relationship between clutch adjustment, horsepower and torque.
2. Describe centrifugal clutch parts and function.
3. Adjust or alter clutch components to optimize performance:
   a) primary clutch
   b) secondary clutch.
4. Perform clutch alignments:
   a) center to center

b) alignment or skew
c) offset
d) belt deflection.

5. Describe drive belt selection.

6. Perform drive belt failure analysis.

B. Tracks ..... 2 Hours

1. Describe snowmobile track types and sizes.

2. Perform track service and maintenance:
   a) alignment
   b) tension
   c) clip replacement
   d) troubleshoot.

3. Describe track selection for specific applications.

4. Describe accessory or replacement track types and modifications:
   a) types and profiles
   b) pitch and driver styles
   c) traction aids
   d) stud types
   e) cleats and claws
   f) paddles
   g) installation and clearances.

C. Driveline ..... 8 Hours

1. Describe the relationship between chaincase ratio driver size, and track configuration:
   a) gear ratios
   b) drivers
   c) track clearance
   d) angle of attack.

2. Remove and replace drive shaft.

3. Remove, replace and recondition chain case.

SECTION EIGHT ..... STEERING AND SUSPENSION ..... 20 HOURS

A. Steering ..... 5 Hours

1. Describe recreational vehicle suspension systems:
   a) steering angles
   b) caster
   c) camber
   d) scrub
   e) bump steer
   f) skid steering
   g) alignment procedures.

2. Perform steering alignment.

3. Describe skis, ski types and wear rods:
   a) carbides length and placement.

B. Shocks ..... 5 Hours

1. Perform shock absorber service:
   a) rebuild shock
   b) re-valve shock.

C. Front Suspension ..... 5 Hours

1. Describe recreation front suspension:
   a) leaf spring
   b) A arm
   c) ball joints
   d) trailing arm
   e) telescopic strut
   f) torsion sway bars.

D. Rear Suspension ..... 5 Hours

1. Describe recreation rear suspension:
   a) slider
   b) bogie
   c) linked or coupled
   d) rising / progressive rate.
2. Describe torque reaction and weight transfer.
3. Perform front and rear suspension adjustments:
   a) weight transfer rods / stops
   b) ride height
   c) spring preload.

SECTION NINE ..... ACCESSORIES AND PERFORMANCE MODIFICATION ..... 10 HOURS

A. Electrical Accessories ..... 1 Hour

1. Describe typical dealer installed electrical accessories:
   a) wiring procedures
   b) battery systems
   c) heated grips
   d) lights and horns
   e) depth and fishfinders
   f) radios
   g) electric winches
   h) alternator output.

B. Engine Accessories ..... 5 Hours

1. Describe other engine accessories:
   a) reeds
   b) lightened components, flywheel etc.
   c) air intake components
   d) turbocharger / supercharger
   e) other.
2. Describe performance enhancing exhaust systems.

3. Describe how managing exhaust flow can improve volumetric efficiency of an engine, including trade offs such as trade offs between peak power and flexible power, noise issues, etc.

4. Describe the effect of exhaust tuning on horsepower curves.

5. Describe the two-stroke performance enhancing exhaust system:
   a) tuned pipe
   b) expansion chamber
   c) stingers
   d) expansion chamber mufflers
   e) effects of pipe temperature.

6. Four stroke pipe tuning:
   a) effect of length on power at specific engine rpm
   b) one into one tuned pipe systems
   c) multi cylinder tuned pipe configurations
   d) mufflers and spark arrestors.

7. Describe the use of a pyrometer in monitoring engine efficiency and performance:
   a) types
   b) installation
   c) location
   d) effect on temperature with location.

C. Hull Accessories ..... 3 Hours

1. Describe the installation considerations for the various hull accessories:
   a) transom jacks
   b) set back plates
   c) trim tabs
   d) ski bars
   e) downriggers
   f) swim platform / ladders
   g) steering and control systems
   h) other.

D. Trailer Accessories ..... 1 Hour

1. Describe trailer accessories:
   a) electric winches
   b) truck decks.

FOURTH PERIOD TECHNICAL TRAINING

TURF AND POWER OUTDOOR POWER EQUIPMENT TECHNICIAN COMBINED COURSE OUTLINE

SECTION ONE ..... ADVANCED FUEL SYSTEMS ..... 25 HOURS

A. Power and Turf Equipment EFI and Sensor Servicing ..... 10 Hours

1. Set up, test and adjust throttle position indicator.
2. Check and test EFI and ECU sensors:
   a) voltage output tests
   b) resistance tests
   c) check and test all temperature sensors
   d) locate and test oxygen sensor
   e) locate and test knock or vibration sensors
   f) test voltage and resistance of the map sensor
   g) perform diagnosis of malfunction indicator light fault codes.
3. Perform model specific diagnostics of sensors using laptops, hand held testers; break out boxes, etc. as required.

B. Liquid Propane Gas ..... 3 Hours

1. Describe characteristics of liquid propane gas.
2. Describe LPG operating Principles.
3. Describe unique components required to operate with LPG fuels.
4. Perform diagnosis and troubleshoot LPG systems.
5. Perform adjustments on LPG systems.
6. Describe safety, legal and gas codes related to LPG systems.
7. Describe modifications required in converting an engine to LPG operation.

C. Kerosene ..... 1 Hour

1. Describe characteristics of kerosene.
2. Describe operating principles of kerosene fueled systems.
3. Describe components required for operating with kerosene fuel.
4. Describe mixture re-adjustment requirements for kerosene fueled engines.

D. Diesel ..... 11 Hours

1. Describe a diesel high-pressure fuel system.
2. Perform model specific pump timing procedures.

3. Perform system troubleshooting:
   a) over fueling (rich)
   b) lean mixture.
4. Perform cylinder cancellation test.

SECTION TWO ..... ADVANCED TRANSMISSIONS ..... 25 HOURS

A. Transaxles ..... 6 Hours

1. Identify transaxles common to power and turf equipment.
2. Describe transaxle service and repair.
3. Identify the cause of gear failure.
4. Perform overhaul of typical transaxle, repair and replace failed or worn components.

B. Shift Mechanisms ..... 1 Hour

1. Describe power and turf shift mechanisms.
2. Diagnose and troubleshoot shifting problems.

C. PTO Drives ..... 2 Hours

1. Describe PTO operation.
2. Remove and replace various types of PTO common to turf and power equipment.
3. Diagnose PTO failure.
4. Set up and adjust PTO mechanism.

D. Final Drives ..... 6 Hours

1. Describe operation of the following drive types:
   a) worm gears
   b) disc drive
   c) chain and sprocket
   d) variable ratio clutch
   e) four wheel clutching systems.
2. Diagnose and troubleshoot the following drive types:
   a) worm gears
   b) disc drive
   c) chain and sprocket
   d) variable ratio clutch
   e) four wheel clutching systems.
3. Service and adjust the following drive types:
   a) worm gears
   b) disc drive
   c) chain and sprocket
   d) variable ratio clutch
   e) four wheel clutching systems.

E. Hydrostatic Drives ..... 10 Hours

1. Describe operation and placement of hydrostatic drive components.
2. Describe priority operation and sequencing of hydrostatic drive components.
3. Describe and practice appropriate safety precautions for hydrostatic drive systems.
4. Diagnose and test hydrostatic operation and components:
   a) directional control
   b) flow
   c) pressure
   d) sequence
   e) priority
   f) hydraulic motors
   g) cylinder
   h) accumulators
   i) hydraulic connections.
5. Repair and or replace hydrostatic drive components.

SECTION THREE..... ELECTRICAL/ELECTRONIC CONTROL SYSTEMS ..... 25 HOURS

A. Safety Interlocks and Relays ..... 15 Hours

1. Identify relays and safety interlock systems as found in turf and power equipment.
2. Trouble shoot relays and safety interlock problems.
3. Describe computer controlled systems.

B. Computer and Automated Control Systems ..... 10 Hours

1. Distinguish between Programmable and non-programmable (analog and digital) systems.
2. Diagnose and troubleshoot control systems.
3. Describe delay switch / timer operation.
4. Diagnose and troubleshoot delay switches and timers.

SECTION FOUR..... CUTTING UNITS ..... 30 HOURS

A. Mowing Equipment ..... 1 Hour

1. Describe and identify mowing equipment:
   a) golf course equipment
   b) parks equipment
   c) residential equipment.

B. Mower Set-up ..... 4 Hours

1. Describe operation adjustment and set up of reel mowers:
   a) reel
   b) bed knife
   c) rollers
   d) shields.
2. Describe operation and set up of rotary mowers:
   a) clipping dispersal decks
   b) mulching decks
   c) blade drives
   d) blade types
   e) blade tip speeds
   f) set-up
   g) leveling.
3. Describe flail mowers:
   a) blade types
   b) set-up.

C. Blade Sharpening ..... 20 Hours

1. Perform the following sharpening techniques:
   a) relief grinding
   b) spin grinding
   c) bed knife grinding
   d) rotary blade sharpening
   e) back lapping
2. Describe bed knife maintenance tools.

D. Chainsaw Chain and Cutting Bar ..... 5 Hours

1. Identify chain types and application of each.
2. Perform chain sharpening using grinders and files.
3. Repair cutting chain sprocket and bar.
4. Perform bar maintenance.
5. Set up and adjust chain, brake and oiling system.
6. Perform chain maintenance and troubleshoot chain problems.

SECTION FIVE ..... POWER EQUIPMENT ..... 30 HOURS

A. Handheld Power Equipment ..... 10 Hours

1. Describe chain saw operation.
2. Perform chainsaw troubleshooting and repair.
3. Describe string trimmer operation.
4. Perform string trimmer troubleshooting and repair.

B. Portable Water Pumps..... 4 Hours

1. Describe water pump operation and parts.
2. Troubleshoot pump operation.
3. Disassemble and diagnose water pump problems.
4. Reassemble and adjust water pump.

C. High Pressure Washers .....6 Hours

1. Describe high-pressure washer operation and parts.
2. Perform high-pressure washer adjustment.
3. Troubleshoot high-pressure washer operation.
4. Perform overhaul of high-pressure pump.

D. Portable Generators .....10 Hours

1. Describe and identify portable generator types:
   a) standard
   b) bobbin
   c) condenser
   d) inverter
2. Describe and test electrical components:
   a) exciter winding
   b) sensor winding
   c) sub winding
   d) field winding rotor
   e) capacitor
   f) rectifier testing
   g) back up coil.
3. Perform the following generator tests:
   a) AC output
   b) DC output
   c) 12 volt field test
   d) low oil shut down
   e) electric fuel solenoid
   f) output frequency and voltage
   g) governor and auto throttle adjustment
   h) auto start operation
   i) loaded engine rpm.
4. Perform an overhaul of the generator unit.

SECTION SIX ..... SPRAYERS ..... 10 HOURS

A. Sprayer Equipment, Chemicals and Handling ..... 4 Hours

1. Describe chemical sprayers as used in the power equipment and turf industry.
2. Describe the precautions required for working with spray chemicals.
3. Describe handling and disposal of various spray chemicals.
4. Describe and identify sprayer components and spray circuits:
   a) tanks
   b) pumps
   c) regulators and gauges
   d) screens and filters
   e) plumbing
   f) nozzles.

B. Sprayer Maintenance ..... 6 Hours

1. Diagnose and troubleshoot spray systems and pressures.
2. Perform a typical calibration.
3. Describe loading sprayers
4. Describe sprayer storing and cleaning.
5. Describe sprayer winterizing procedures.

SECTION SEVEN ..... IRRIGATION ..... 20 HOURS

A. Irrigation Hydraulics ..... 1 Hour

1. Describe irrigation hydraulic fundamentals:
   a) pressure conversion
   b) friction loss
   c) flow velocity
   d) H_2O hammer.

B. Irrigation Equipment ..... 9 Hours

1. Identify heads, types and coverage characteristics.
2. Service and inspect heads.
3. Describe solenoid valves.
4. Describe valves and controllers.
5. Describe field satellite operation.
6. Describe irrigation plumbing and piping.
7. Describe irrigation fittings.
8. Describe the purpose of thrust blocks.

9. Describe pumping systems.
10. Describe irrigation pumps.
11. Describe pump drives replacement.

C. Irrigation System Service ..... 10 Hours

1. Describe basic system design.
2. Describe equipment selection.
3. Describe system maintenance.
4. Describe operational maintenance.
5. Describe shut down and start up.
6. Describe irrigation system winterization procedures.

SECTION EIGHT ..... GOLF CARTS ..... 15 HOURS

A. Electric Carts and Chargers ..... 10 Hours

1. Describe the operation of electric golf carts.
2. Describe deep cycle 36 and 48-volt systems.
3. Describe the operating requirements for battery powered golf carts.
4. Describe deep cycle battery servicing procedure.
5. Test deep cycle battery condition and capacity.
6. Diagnose and test operation of electric components.
7. Describe line voltage charging systems.
8. Test and diagnose charger condition and output.
9. Describe fleet rotation and cart barn set up.

B. Golf Cart Mechanicals ..... 5 Hours

1. Describe golf cart steering boxes:
   a) worm gear
   b) rack and pinion.
2. Service and adjust golf cart steering systems.
3. Describe the golf cart two-stroke engine reversing system.
4. Describe starter generator systems.

Alberta Apprenticeship and Industry Training

Excellence through training and experience

5103

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

[X] This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

[ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").